Know the Earth…Show the Way

What Warfighters Need to Know About NGA Products and Services

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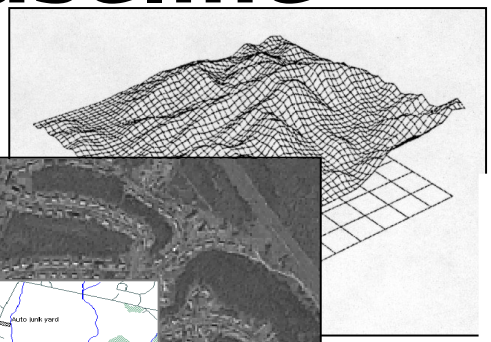
Overview

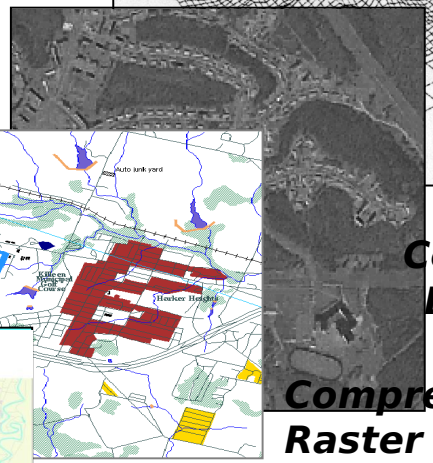
- **An overview of NGA products and services**
- NGA Geospatial products
- NGA Imagery products
- NGA services and how to get them

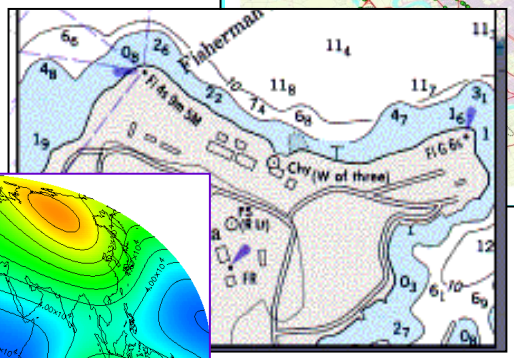
Overview of NGA Products

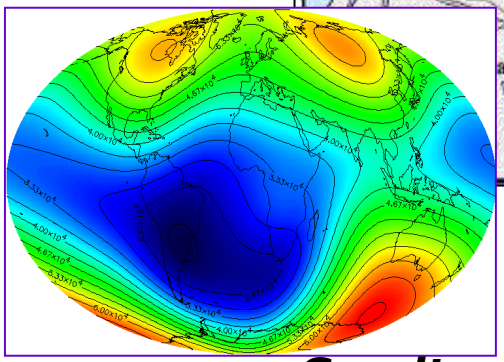
- Hardcopy products – paper maps and imagery
- Raster data – digitized maps and imagery data
- Matrix data – example: Digital Terrain Elevation Data® (DTED®)
- Vector data –powerful geospatial data supporting analysis
- Custom products – exercise or mission-specific

Geospatial Product Baseline









Elevation (SRTM and DTED®)

Controlled Imagery Base (CIB®) 1,5,10

Compressed Arc Digitized Raster Data (CADRG/ADRG)

Vector Map VMAP 0,1,2

Digital Nautical Chart (DNC®)/FLIP

Gravity Products

Different Products to Enhance Varying Capabilities

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Geospatial Product Issues

- Map coverage
- Map Scale
- Maps vs the real world
- Map accuracies
- Product currency
- Datums

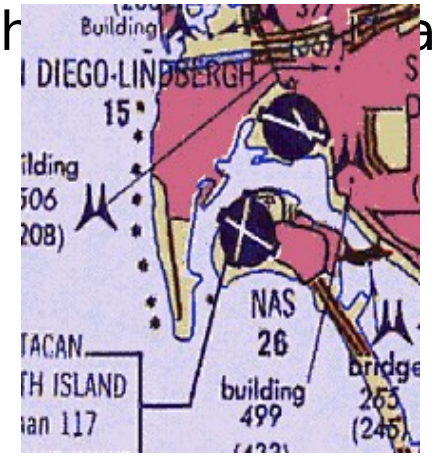
Geospatial Product Issues- Map Coverage

- Standard Maps take a long time to produce. Example: Topographic Line Maps
- There are 19,200 1 degree cells of landmass on earth
  - 4 1:100K sheets or 16 1:50K sheets per cell
- Only 10-12% of the earths surface is mapped at 1:50 or 1:100 scale
- Alternate products may be available – check with your NGA Support Team

Geospatial Product Issues - Map Scale

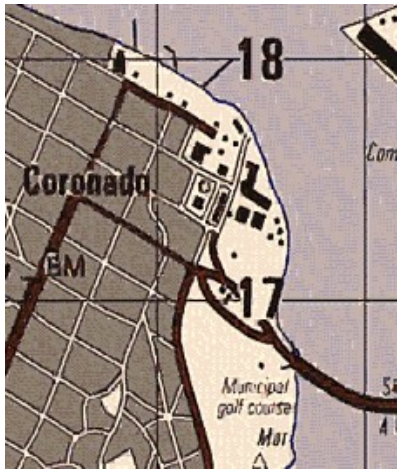
- Different scale maps are designed for different purposes
- The number and kind of features that can be shown on a map depends on the scale: larger scale, more detail
- Scale is a function of the amount of ground the map covers: 1:50k larger scale than 1:1M
- h ac

1:2,000,000



1:500,000

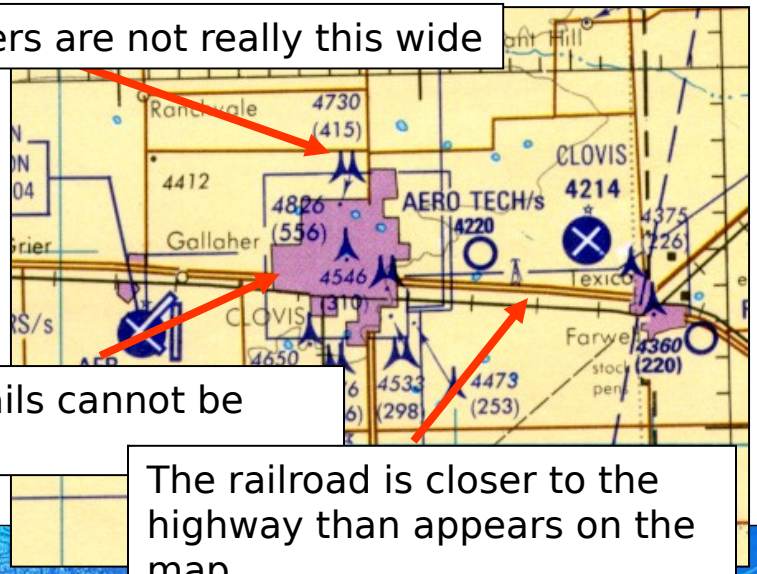
1:250,000

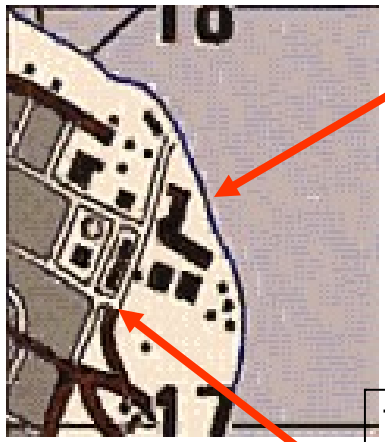


1:50,000

Geospatial Product Issues - Maps versus "the Real World"

- There is insufficient room on a map to depict all features – cartographic license is at work
- Features shown are dependent on scale – more features appear on a 1:50,000 map than a 1:250,000 map
- Features must be generalized to make the map understandable – depicts relationships rather than





Geospatial Product Issues – Map Accuracy

- Features on a map must be adjusted to show their relationship to each other rather than their exact position; therefore, points plotted on a map may not exactly match GPS receiver coordinates
- Different scale maps have different accuracy

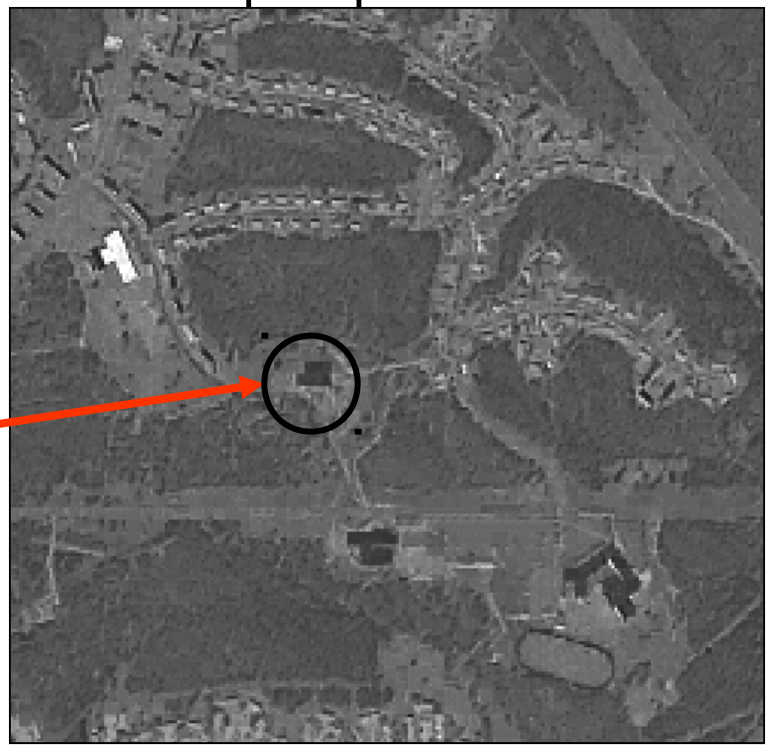
Chart/Map	Scale	Potential Error Distance (Meters)
City Graphic	1:25,000	more than 50
Topo	1:50,000	50
JOG	1:250,000	250
TPC	1:500,000	1000
ONC	1:1,000,000	2000

Geospatial Product Issues - Product Currency

- Features on a map are as current as the image used to create it
- New features could be built after the map is printed

1978 Map

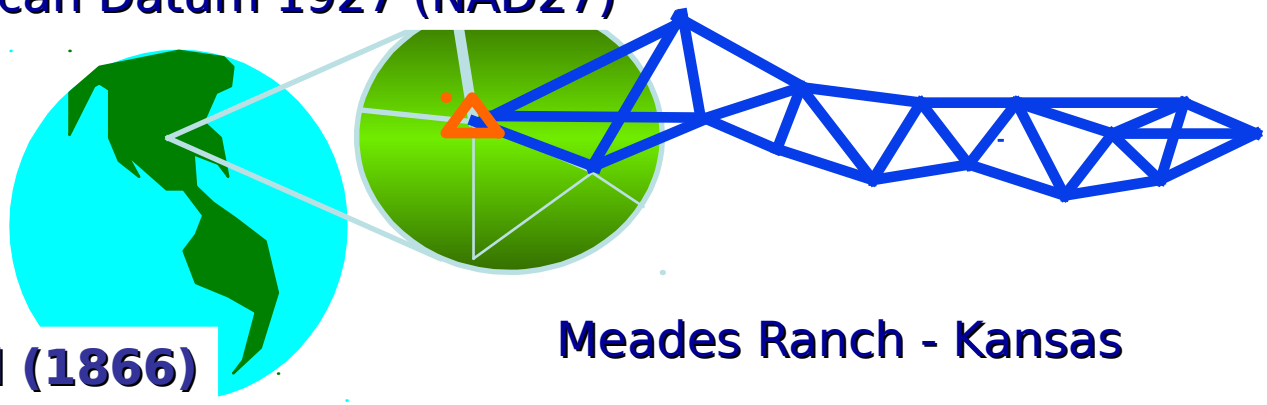
1997 Image reveals a new building



Geospatial Product Issues - Datums

- ***Horizontal Datum***:
  - a **base reference for a coordinate system**. It includes the position and orientation of an initial ***point of origin*** (control point) and an ***ellipsoid*** that models the surface of the Earth w/in the region of interest.

Ex // North American Datum 1927 (NAD27)



Clarke Ellipsoid (1866)

Meades Ranch - Kansas

Datums - Modeling the Earth

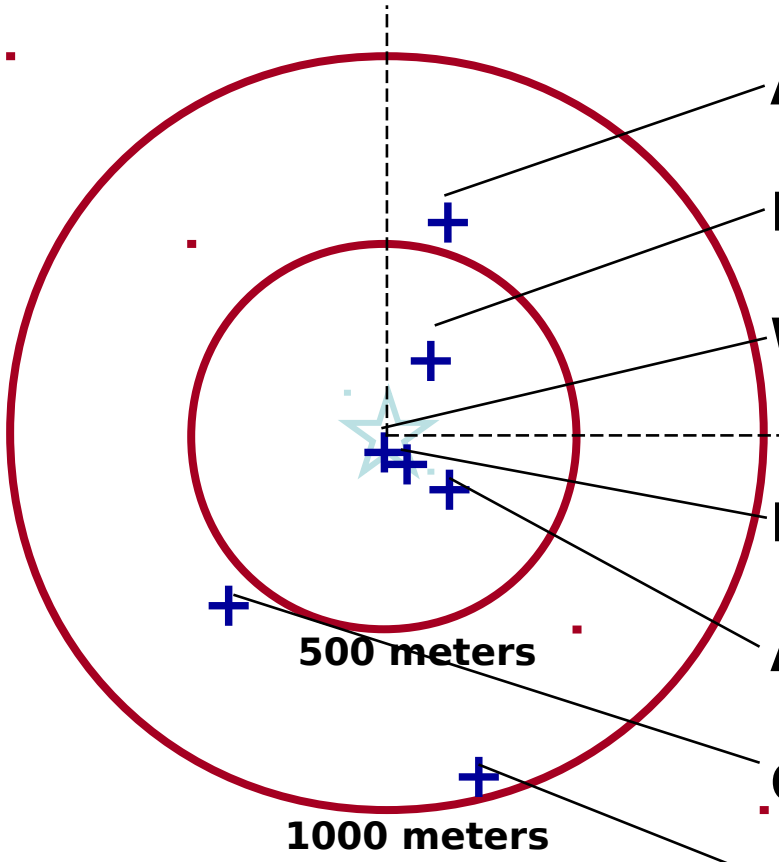
What is the problem for DoD?

- WGS 84 is used on ***all digital*** and on almost all other new NGA-produced GI&S products
- There are still hundreds of legacy local datums in use throughout the world on existing products
  - > 30 Datums with > 5 Ellipsoids used by NGA
  - > 150 Datums with > 25 Ellipsoids used by others
- It would take NGA years and lots of DoD money to update the entire existing product line
- NGA (and you) can transform datums and convert coordinates between WGS 84 and over 120 local datums

Modeling the Earth - Datum Shifts

97:44:25.19 West Longitude (WGS

Horizontal Benchmark - Texas Capital Dome



Arc 1950

European Datum 1950

WGS-72

30:16:28.82 North Latitude (WGS

NAD 27

Australian Geodetic System 1984

Ordnance Survey 1936

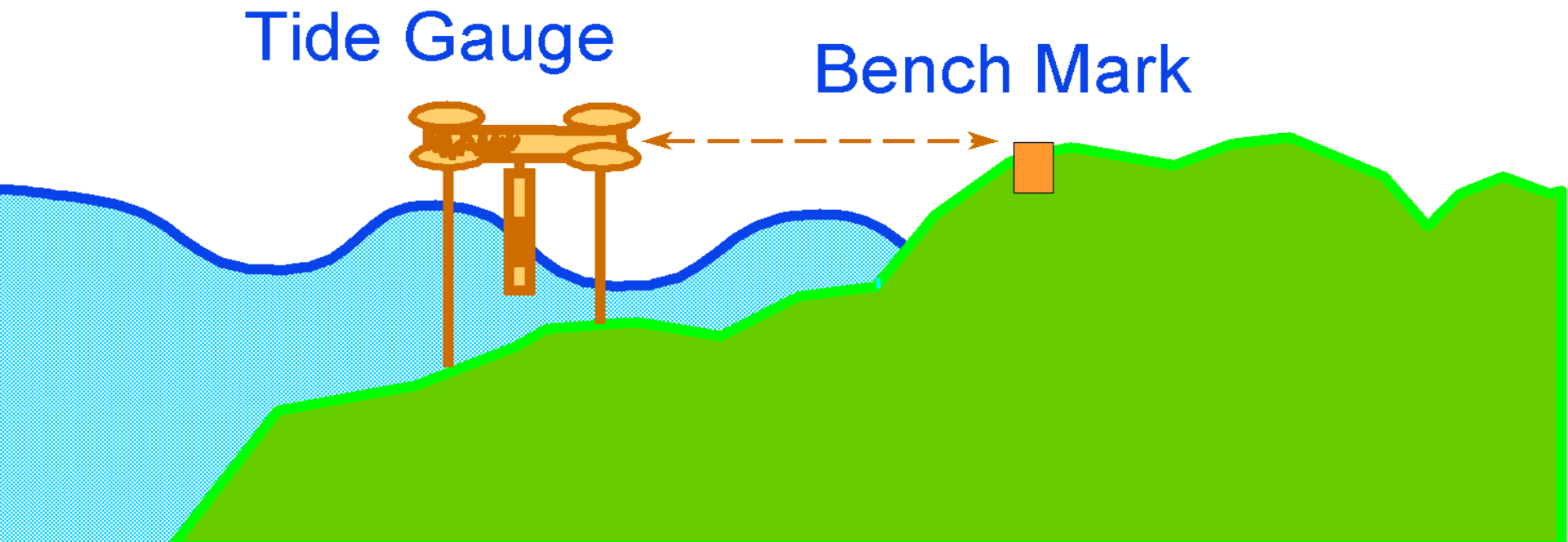
Tokyo

Modeling the Earth - Transformation Software

- **GEOTRANS v2.0.3** (GEOgraphic TRANSlator)
  - Mapping Accuracy Transformations for preset datum and coordinate systems. The DoD recommended system.
- FalconView™ / PFPS (Uses GeoTrans algorythms)
  - Mapping Accuracy Transformations in conjunction with map display and mission planning - single transformations
- PLGR/EPLGR Built in transformation software for coordinate transformations
- COTS - ArcView®, ArcInfo®, & ERDAS Imagine® have varying capabilities for datum shifts and coordinate conversions

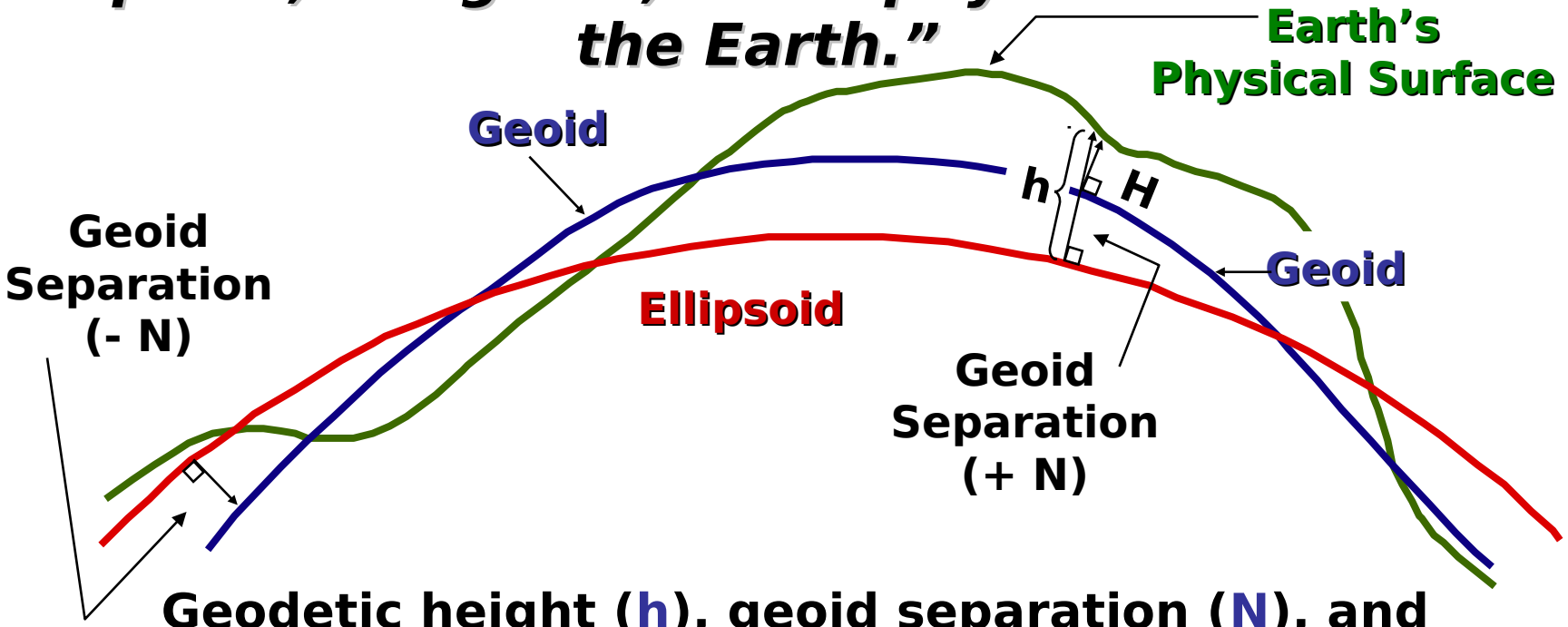
Modeling the Earth - Vertical Datums

- **Traditional surveys** are referenced to Mean Sea Level (MSL), which is commonly referred to as the Geoid.
  - *The **geoid** is a closed surface of constant gravity potential approximated by MSL & the theoretical extension of MSL through land areas.*



Modeling the Earth - Vertical Datums

"The relationship between the reference ellipsoid, the geoid, & the physical surface of the Earth."



Geodetic height (h), geoid separation (N), and elevation (H) are depicted above and related by:

h ~ H + N

H (*orthometric height*) is measured traditionally

N is modeled using Earth Gravitational Model 96

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Imagery Product Issues

- Imagery sources
- Spatial resolution
- Accuracy
- Imagery currency

Imagery Product Issues - Imagery Sources

- National Technical Means (NTM)
- Commercial Imagery – EO, IR Radar
- Tactical Imagery – Still and Motion Imagery

Imagery Sources - National Technical Means

- Satellites Operated by the National Reconnaissance Office (NRO)
- Tasking managed by NGA
- Highly capable
- Highly competitive for collection
- Classified imagery
- Satellites are not discussed further in this deck due to classification issues

Imagery Sources - Commercial Imagery

- Imagery is unclassified
- It costs money!
- NGA centrally manages purchases for USG
- Air Force has it's own budget for commercial
- Lots of sources:
  - IKONOS (Space Imaging - US)
  - IRS (India)
  - QuickBird (DigitalGlobe - US)
  - RadarSat (Canada)
  - SPOT (France)
  - Etc

Imagery Sources - Airborne Imagery

- Timely
- Tasked by theater commander
- Largely unclassified
- Lots of sources :
  - U-2 SYERS (EO)
  - U-2 ASARS (SAR)
  - Predator
  - Global Hawk
  - E-8 JSTARS
  - F-18 ATARS
  - F-14 TARPS
  - Future Capabilities – F/A-22 and F-35 High Resolution SAR with Auto Target Cueing (ATC)

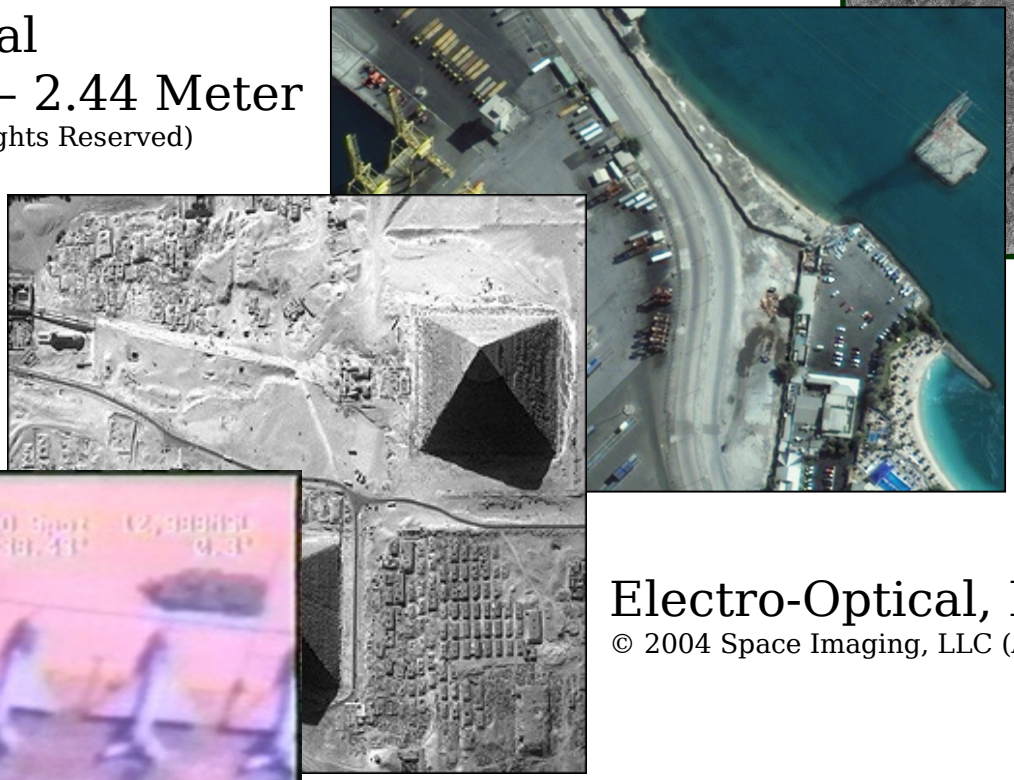
Imagery Product Issues - Imagery Types

- Wet Film
- Electro-optical
- Synthetic Aperture Radar
- Infra-Red
- Spectral
  - Multi-Spectral
  - Hyper-Spectral
  - Ultra-Spectral

Imagery Product Baseline

Synthetic Aperture Radar
RADARSAT 1 – 8 Meter

Multi-Spectral
QuickBird 2 – 2.44 Meter



Electro-Optical, IKONOS - 1Meter

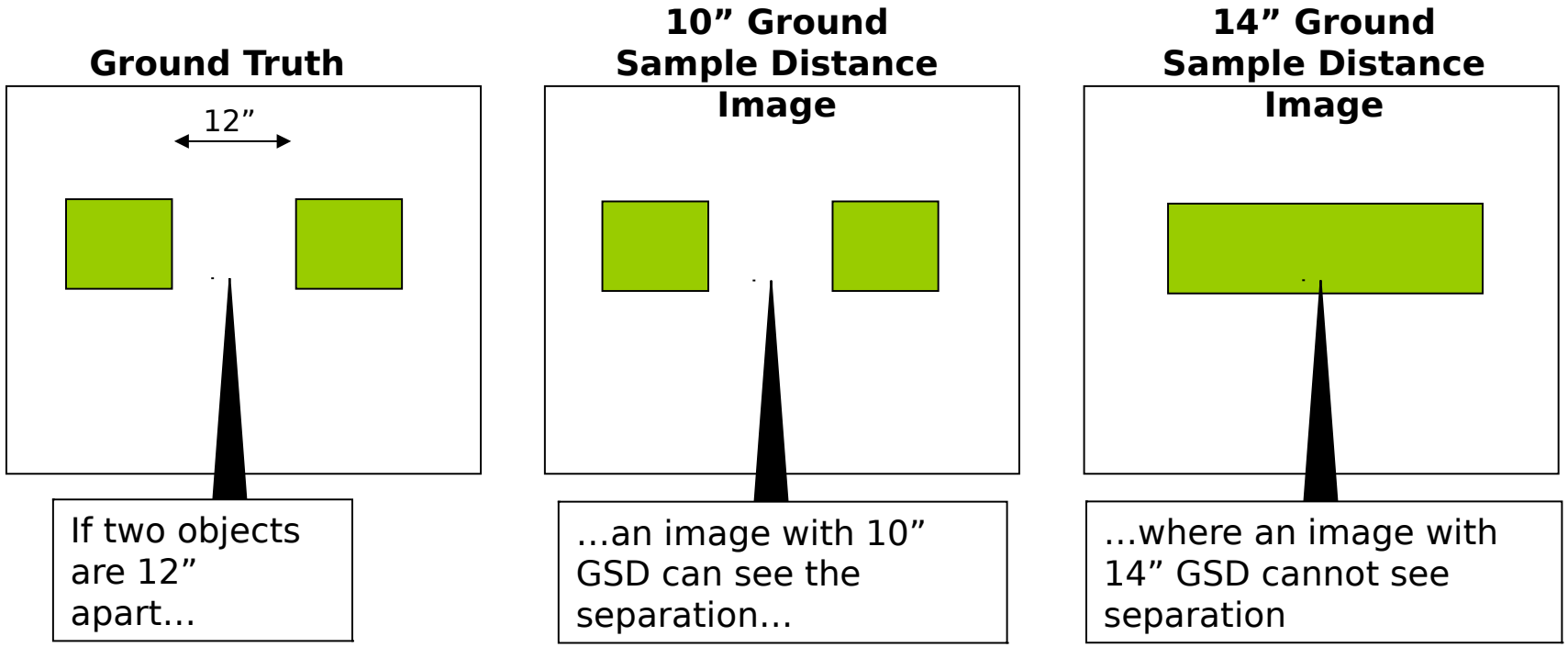
Predator Motion Imagery

Imagery Product Issues -Imagery Spatial Resolution

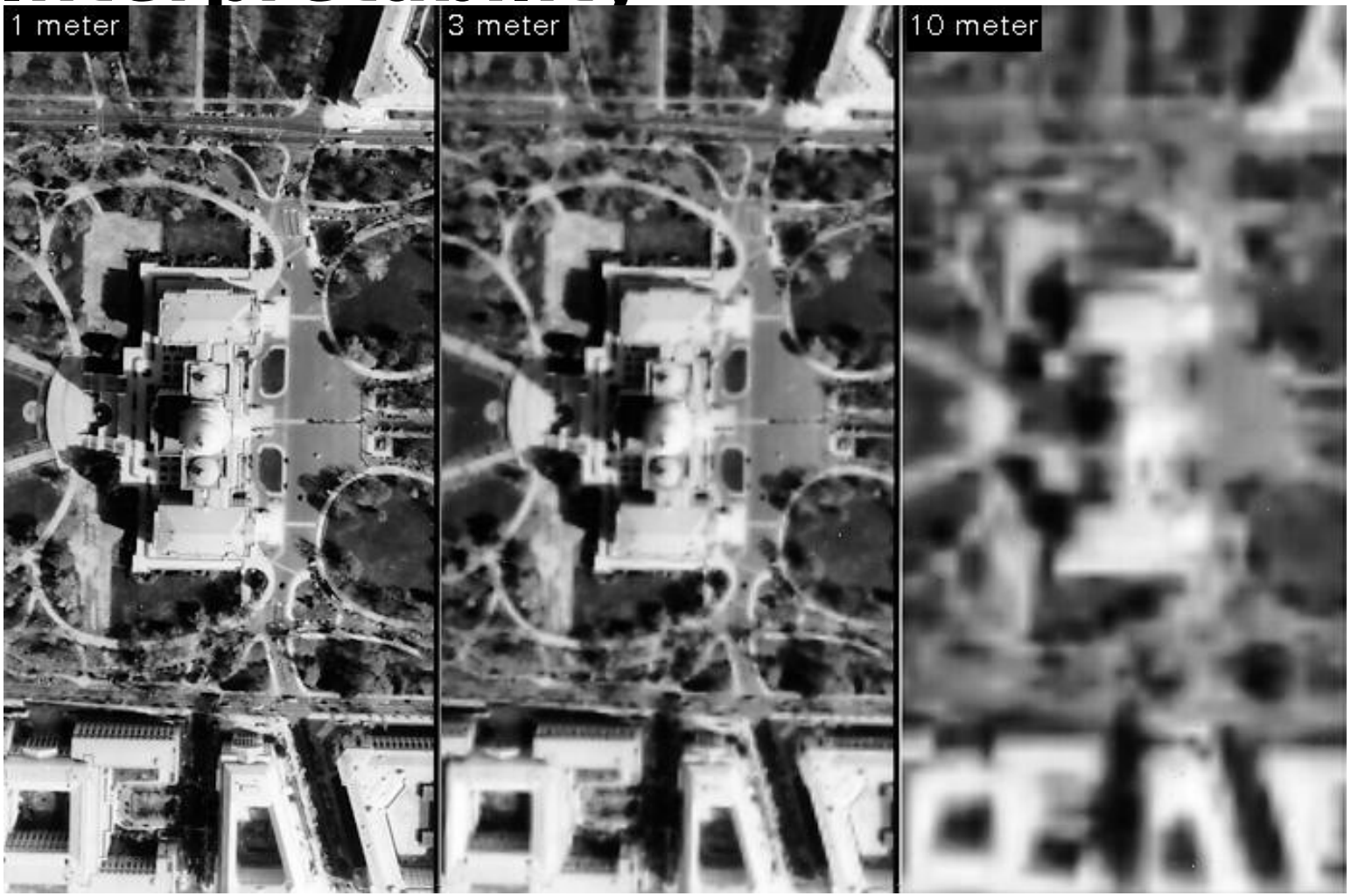
- “Sharpness” of the imagery
- Measured in ground sample distance
- Can also be measured in NIIRS (national imagery interpretation Rating Scale)
- Examples:
  - CIB® 1, 5, 10 (1, 5, 10 Meter GSD)
  - Commercial sources: 1 M Ikonos, 0.6 M Quickbird
  - U-2/GH

Ground Sample Distance (GSD) Defines Image Resolution And Quality

- Ground Sample Distance is the minimum distance between two objects that can be detected in a given image



GSD Considerably Changes Interpretability



DigitalGlobe QuickBird 2

Imagery Accuracy

- Positional accuracy of imagery vs ground truth
- Different than resolution – you can have high res imagery with poor position accuracy
- Future Platforms (F/A-22, F-35) will have high resolution imagery with high resolution accuracy
- Examples:
  - CIB®; has a specified accuracy of 23 M
  - DPPDB®; Stereo pair mensuration allows predicted accuracy
  - Commercial and tactical imagery may be of unknown accuracy

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How to get NGA Products

- **Order existing products (hardcopy and softcopy) through supply**
  - **Products are shipped from Defense Logistics Agency (DLA)**
  - http://www.dscr.dla.mil/pc9
- **Contact AFMC for DODAAC Account management:**
  - **Information on account establishment process can be found at:** https://dodaac.wpafb.af.mil

How to get NGA Products, Cont'd

- **Products can be downloaded from NGA's Gateway**
  - INTELINK – SIPRNET http://www.nga.smil.mil
  - INTELINK – JWICS http://www.nga.ic.gov
- **NGA GATEWAY Data Bundling Services**
  - UNCL FIREWIRE@nga.mil (email)
  - SIPR http://www.nga.smil.mil
    (select Services, NGA Data Bundler)
  - JWICS
    http://reachback.stl.nga.ic.gov/NIMAMUSE/webinter/data_bundle.html

How to get NGA Products, Cont'd

- **Air Force GPL program provides data delivery services and storage libraries**
  - AMC POC: alice.prichard@scott.af.mil
  - ACC POC: richard.macy@langley.af.mil
- **Call customer support if:**
  - The product you want is out of stock
  - You need US Geological Survey (USGS) or local source products
    - USGS products can be viewed at http://www.USGS.Gov
  - You need a new product produced
  - You need training or expertise

Imagery Data Holdings

- Airborne / Tactical libraries standing up to store airborne imagery
  - Web Access & Retrieval Program (WARP)
    - Allows access to NTM, airborne and commercial imagery
    - Access from SIPRNET or JWICS
    - WARP Registration: http://7.176.50.194/
  - Community Airborne Library Architecture (CALA)
    - Will hold airborne still imagery (not motion imagery) Access from SIPRNET and SCI
    - CALA Homepage: http://www.nga.ic.gov/work-group/cala/index.html
- Commercial Imagery libraries
  - Commercial Satellite Imagery Libraries (CSIL) - Central storage for DOD purchased commercial imagery – holdings can be searched on line
    - http://csil.nga.ic.gov/csil
  - Dissemination by Skymedia (80 receivers at/above JTF level) or CD via mail

Customer Service is Available

- NGA Support Teams handle operational and training issues
  - NGA production is determined by Combatant Command and Service requirements
- NGA's Support Teams (NST) are the central point for Customer Relations. They are your NGA resource!
- Training and instructional materials are available through the NGA Geospatial Intelligence College
- NGA Fact Sheets are available
  - http://www.nga.ic.gov/publications/index.html
  - http://www.nga.mil/mil (reference materials)

NGA SUPPORT TEAMS

Navy	570	703-264-3002
Marine Corps	570	703-264-3004
DIA	428	202-231-4831
NORTHCOM	570	703-264-3006
USCENTCOM	287	301-227-1570
USEUCOM	570	703-264-3007
USJFCOM	570	703-264-3006
USPACOM	570	703-264-6176
USSOUTHCOM	570	703-264-3013
USSPACECOM	570	703-264-3008
USSTRATCOM	693	314-263-4895
USTRANSCOM	693	314-263-4895
SOCOM	287	301-227-1556
National, Civil and Federal Law Enforcement Customers		703-264-3019
State Department		202-647-5130
CIA		703-482-0977
NSA		301-688-5496
NGA Public Affairs		301-227-2057
NGA Convention Support Office		301-227-1403
NGA Geospatial Intel College		703-805-3268

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

Know the Earth…Show the Way